



Problem G

Grammar

Input File: G.in

Output File: standard output

Program Source File: G.c, G.cpp, G.java

Bob is one of the best students of the Formal Languages class. Now he is learning about context free grammars in the Chomsky Normal Form (CNF). Such a grammar consists of:

- a set of nonterminal symbols N
- a set of terminal symbols T
- a special nonterminal symbol, called the start symbol S
- a set R of rules of the form $A \rightarrow BC$ or $A \rightarrow a$, where $A, B, C \in N, a \in T$.

If $A \in N$, we define $L(A)$, the language generated by A , as follows:

$$L(A) = \{ wz \mid w \in L(B), z \in L(C), \text{ where } A \rightarrow BC \in R \} \cup \{ a \mid A \rightarrow a \in R \}.$$

The language generated by the grammar with start symbol S is defined to be $L(S)$.

Bob must solve the following problem: for a given context free grammar in CNF, on input string x , determine whether x is in the language generated by the grammar, $L(S)$.

The program input is from a text file. It starts with the input string x ($|x| \leq 1000$). Follows the grammar rules, in the form ABC or Aa , each on a separate line. We consider that the start symbol is always S . The program prints 1 if the string is in the language generated by the grammar, 0 otherwise.

The input data are correct and terminate with an end of file. The program prints the result to the standard output from the beginning of a line.

Input/output samples are given in the table below. There are three tests. The first two use the same grammar: SAB, Sa, Ab ($S \rightarrow AB, S \rightarrow a, A \rightarrow b$). For the first test the input string is a , and the result is 1, while for the second test the input string is ab and the result is 0.

Sample input	Sample output
a SAB Sa Ab	1
ab SAB Sa Ab	0
ab SAB Sa Ab Ba	0